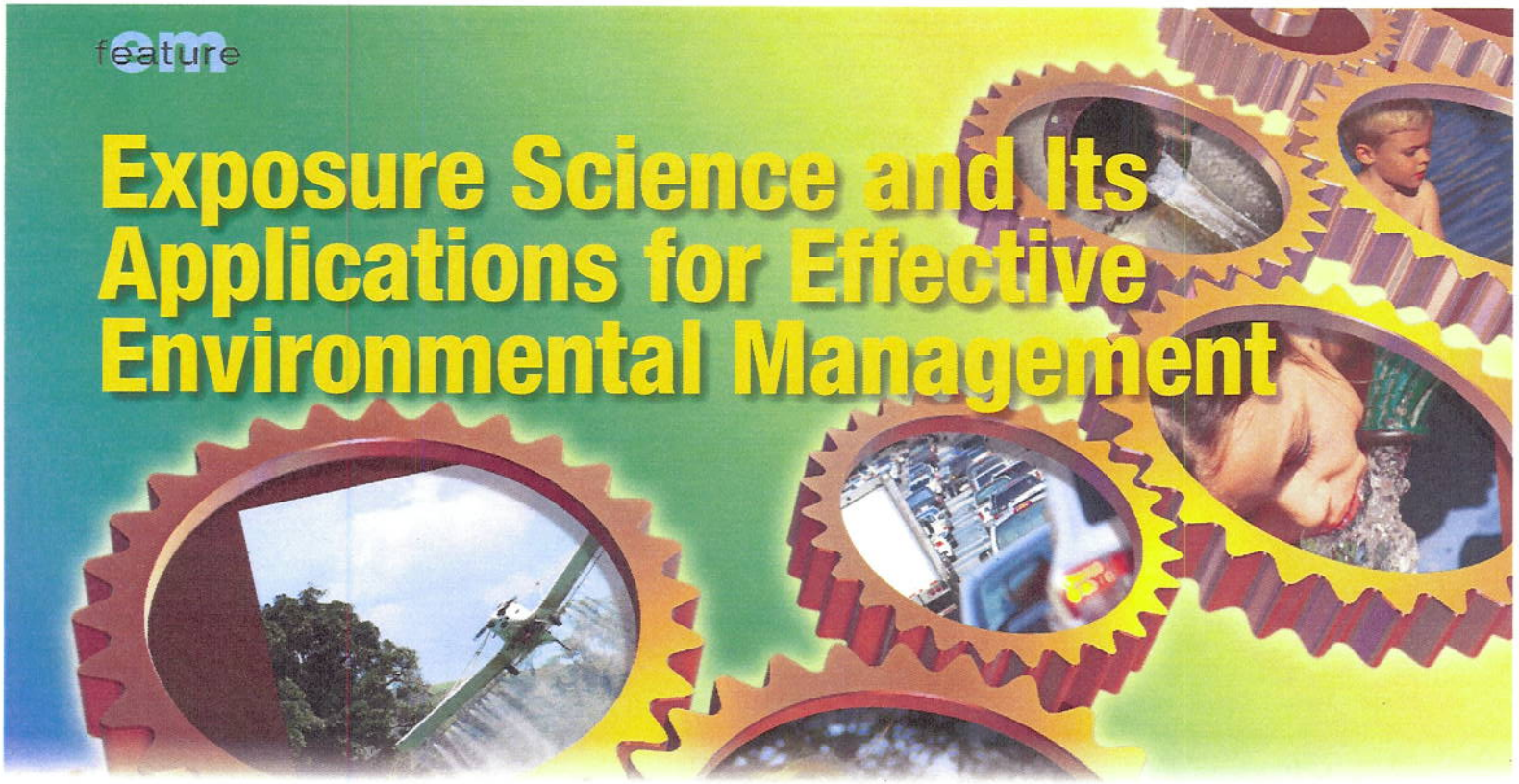
Exposure Science and Its Applications for Effective Environmental Management



Environmental quality in the United States has improved substantially over the past three decades largely because of the implementation of pollution control programs. However, it is unclear whether the rules and regulations that have brought improvements in air and water quality are responsible for concomitant improvements in human and ecosystem health. Traditionally, pollution control programs are aimed at meeting and maintaining the standards (e.g., the National Ambient Air Quality Standards), which reflect the levels of outdoor pollutant concentrations needed to adequately safeguard human health and the environment.

It is becoming increasingly clear that ambient concentrations measured at a single location may not truly represent pollutant exposures for humans or ecosystems. For example, recent studies reveal that ambient concentration levels and human exposure levels are not the same. It is important to understand exposure levels and how exposure information can be used to gain a better understanding of the relationships between environmental quality and human/ecosystem health. These relationships should help improve environmental management practices.

Exposure is the link between environmental pollution and human and ecosystem health. Exposure science entails a thorough understanding of the scientific processes affecting source emissions, pollutant transport and fate, spatiotemporal variability in the ambient concentrations, levels of contaminants that people breathe in, and stressors to sensitive ecosystems. Environmental management has historically focused on the source-to-outcome approach, but it is now becoming increasingly important to understand the linkages from outcome back to source.

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The articles that follow in this issue of *EM* discuss the need for advancing exposure science and its applications to better protect human and ecosystem health, and the resulting challenges confronting environmental managers. The first article by Sheldon et al. (page 8) outlines a framework for exposure research. This is followed by an article by Levy and Reiss (page 14), which focuses on exposure modeling and risk assessment. The third article by Ozkaynak et al. (page 18) discusses the uncertainties associated with exposure modeling. This is followed by an article by Watkins et al. (page 24), which presents the role of exposure science in air quality management. The fifth article by Garcia et al. (page 29) addresses the evaluation of the effectiveness of the emission control programs that have been implemented in improving human/ecosystem health as part of accountability. This is followed by an article by Hauchman (page 36), which deals with exposure to waterborne pathogens. The final article by Fulk et al. (page 39) discusses the biomonitoring needs for exposure reconstruction. It should be noted that the views expressed in these articles do not necessarily reflect the views and policies of the U.S. Environmental Protection Agency. **em**

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